Final Report Summary - GLIMER (Global Lithospheric Imaging using Earthquake Recordings)

The objective of the project GLImER was to conduct a global survey of lithospheric interfaces using converted teleseismic body waves that are commonly called “receiver functions” (or RFs for short). Data from permanent and temporary seismic networks worldwide were processed automatically to produce global maps of key interfaces (Moho, intra-lithospheric interfaces, lithosphere-asthenosphere boundary). These seismic results can now be interpreted in conjunction with constraints from complementary fields of the earth sciences such as tectonics, geodynamics, petrology, and geochemistry. This provides a unique view of how the properties of these interfaces vary between different tectonic environments and thus how the interfaces relate to geological processes at work in these various environments. The results are to be distributed to the scientific community in the form of data products through an original web-based application. They are also included in an outreach program aimed at increasing awareness about solid earth sciences.

The project has now run the course of its 4-year funding period, during which we have successfully achieved the original goals outlined above. The bulk of the work has focused on implementing an automated workflow to process converted teleseismic waves, applying this workflow to a large global dataset, and developing the tools that allows users to visualize the resulting data products. These tools will be made publicly available through the project’s website (http://stephanerondenay.com/glimer-web.html) and eventually through the European Plate Observing System – Norway (EPOS-N, http://www.geo.uib.no/epos-no/EPOS-N-about.html) project.

At the outset of the project, the standard approach to generate receiver function images at regional scale was to manually select suitable seismic traces and adjust the analysis parameters to obtain optimal RFs for each event/station pair. This represented a very time-consuming undertaking. With GLImER, we have generated a comprehensive dataset of global RFs that allows scientists to bypass this traditionally user-intensive processing step and jump directly to the interpretation stage (or to more sophisticated imaging strategies). Though there are other RF databases out there, notably EARS, none was specifically designed to produce a comprehensive set of global RFs that are readily amenable for imaging – as is GLImER. As such, GLImER brings new state-of-the-art tools to image earth structures at scales and resolutions that were not available before.

We have generated a database that contains 1,300,424 individual receiver functions from 8257 stations globally. These will be viewable through a dedicated map-based application (www.stephanerondenay.com/glimermap) and via mapping programs to be distributed to users after the article describing the GLImER database has been published (manuscript entitled “GLImER – A new global database of teleseismic receiver functions for imaging Earth structure” currently in review at Seismological Research Letters). These data products have already been used in two more focused studies, to appear in the PhD thesis of Kathrin Spieker (UiB): (1) the crustal and upper mantle structure beneath the Azores Islands, and (2) long-range profiles of mantle structures across tectonic boundaries. This work has been presented in oral and poster presentations at national and international conferences, and is featured in (or has contributed to) eight publications that are either submitted of in the preparation stage. Results from GLImER also form a basis for ongoing and future outreach programs, including presentations to Norwegian high-school students and permanent displays of GLImER receiver function data products.
The project has played a central role in the integration of the PI, Stéphane Rondenay, in the Norwegian and European geosciences community since he moved from the US five years ago. It has allowed him to attend international conferences and travel to national and international universities where he has established new connections with European scientists. These activities have allowed his research group to grow, by attracting outstanding graduate students and interns, and have strengthened his national and international network, having led to the development of new research projects.

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### Subjects

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